

Schelhaas Deposition Exhibit 6
01/19/22 TLS

MINNESOTA COMMERCIAL DRIVER'S MANUAL



2005 Model Commercial Driver's License Manual

This lets you use some power through the curve to help the vehicle be more stable while turning. It also allows you to speed up as soon as you are out of the curve.

2.3.2 – Multi-speed Rear Axles and Auxiliary Transmissions

Multi-speed rear axles and auxiliary transmissions are used on many vehicles to provide extra gears. You usually control them by a selector knob or switch on the gearshift lever of the main transmission. There are many different shift patterns. Learn the right way to shift gears in the vehicle you will drive.

2.3.3 – Automatic Transmissions

Some vehicles have automatic transmissions. You can select a low range to get greater engine braking when going down grades. The lower ranges prevent the transmission from shifting up beyond the selected gear (unless the governor rpm is exceeded). It is very important to use this braking effect when going down grades.

2.3.4 – Retarders

Some vehicles have "retarders." Retarders help slow a vehicle, reducing the need for using your brakes. They reduce brake wear and give you another way to slow down. There are four basic types of retarders (exhaust, engine, hydraulic and electric). All retarders can be turned on or off by the driver. On some vehicles the retarding power can be adjusted. When turned "on," retarders apply their braking power (to the drive wheels only) whenever you let up on the accelerator pedal all the way.

Because these devices can be noisy, be sure you know where their use is permitted.

Caution. When your drive wheels have poor traction, the retarder may cause them to skid. Therefore, you should turn the retarder off whenever the road is wet, icy or snow covered.

Subsections 2.2 and 2.3**Test Your Knowledge**

1. Why should you back toward the driver's side?
2. If stopped on a hill, how can you start moving without rolling back?
3. When backing, why is it important to use a helper?
4. What's the most important hand signal that you and the helper should agree on?
5. What are the two special conditions where you should downshift?
6. When should you downshift automatic transmissions?
7. Retarders keep you from skidding when the road is slippery. True or False?
8. What are the two ways to know when to shift?

These questions may be on the test. If you can't answer them all, re-read subsections 2.2 and 2.3.

2.4 – Seeing

To be a safe driver you need to know what's going on all around your vehicle. Not looking properly is a major cause of crashes.

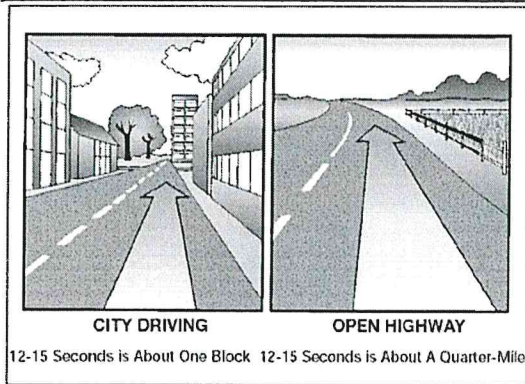
2.4.1 – Seeing Ahead

All drivers look ahead; but many don't look far enough ahead.

Importance of Looking Far Enough Ahead.

Because stopping or changing lanes can take a lot of distance, knowing what the traffic is doing on all sides of you is very important. You need to look well ahead to make sure you have room to make these moves safely.

How Far Ahead to Look. Most good drivers look at least 12 to 15 seconds ahead. That means looking ahead the distance you will travel in 12 to 15 seconds. At lower speeds, that's about one block. At highway speeds it's about a quarter of a mile. If you're not looking that far ahead, you may have to stop too quickly or make quick lane changes. Looking 12 to 15 seconds ahead doesn't mean not paying attention to things that are closer. Good drivers shift their attention back and forth, near and far. Figure 2.6 illustrates how far to look ahead.

2005 Model Commercial Driver's License Manual**Figure 2.6**

Look for Traffic. Look for vehicles coming onto the highway, into your lane, or turning. Watch for brake lights from slowing vehicles. By seeing these things far enough ahead, you can change your speed, or change lanes if necessary to avoid a problem. If a traffic light has been green for a long time it will probably change before you get there. Start slowing down and be ready to stop.

2.4.2 – Seeing to the Sides and Rear

It's important to know what's going on behind and to the sides. Check your mirrors regularly. Check more often in special situations.

Mirror Adjustment. Mirror adjustment should be checked prior to the start of any trip and can only be checked accurately when the trailer(s) are straight. You should check and adjust each mirror to show some part of the vehicle. This will give you a reference point for judging the position of the other images.

Regular Checks. You need to make regular checks of your mirrors to be aware of traffic and to check your vehicle.

Traffic. Check your mirrors for vehicles on either side and in back of you. In an emergency, you may need to know whether you can make a quick lane change. Use your mirrors to spot overtaking vehicles. There are "blind spots" that your mirrors cannot show you. Check your mirrors regularly to know where other vehicles are around you, and to see if they move into your blind spots.

Check Your Vehicle. Use the mirrors to keep an eye on your tires. It's one way to spot a tire fire. If you're carrying open cargo, you can use the mirrors to check it. Look for loose straps, ropes, or chains. Watch for a flapping or ballooning tarp.

Special Situations. Special situations require more than regular mirror checks. These are lane changes, turns, merges and tight maneuvers.

Lane Changes. You need to check your mirrors to make sure no one is alongside you or about to pass you. Check your mirrors:

- ☐ Before you change lanes to make sure there is enough room.
- ☐ After you have signaled, to check that no one has moved into your blind spot.
- ☐ Right after you start the lane change, to double-check that your path is clear.
- ☐ After you complete the lane change.

Turns. In turns, check your mirrors to make sure the rear of your vehicle will not hit anything.

Merges. When merging, use your mirrors to make sure the gap in traffic is large enough for you to enter safely.

Tight Maneuvers. Any time you are driving in close quarters, check your mirrors often. Make sure you have enough clearance.

How to Use Mirrors. Use mirrors correctly by checking them quickly and understanding what you see.

- ☐ When you use your mirrors while driving on the road, check quickly. Look back and forth between the mirrors and the road ahead. Don't focus on the mirrors for too long. Otherwise, you will travel quite a distance without knowing what's happening ahead.
- ☐ Many large vehicles have curved (convex, "fisheye," "spot," "bugeye") mirrors that show a wider area than flat mirrors. This is often helpful. But everything appears smaller in a convex mirror than it would if you were looking at it directly. Things also seem farther away than they really are. It's important to realize this and to allow for it. Figure 2.7 shows the field of vision using a convex mirror.

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When putting out the triangles, hold them between yourself and the oncoming traffic for your own safety. (So other drivers can see you.)

Use Your Horn When Needed. Your horn can let others know you're there. It can help to avoid a crash. Use your horn when needed. However, it can startle others and could be dangerous when used unnecessarily.

2.6 – Controlling Speed

Driving too fast is a major cause of fatal crashes.

You must adjust your speed depending on driving conditions. These include traction, curves, visibility, traffic and hills.

2.6.1 – Stopping Distance

Perception Distance + Reaction Distance + Braking Distance = Total Stopping Distance

Perception Distance. The distance your vehicle travels, in ideal conditions; from the time your eyes see a hazard until your brain recognizes it. Keep in mind certain mental and physical conditions can affect your perception distance. It can be affected greatly depending on visibility and the hazard itself. The average perception time for an alert driver is 1¼ seconds. At 55 mph this accounts for 142 feet traveled.

Reaction Distance. The distance you will continue to travel, in ideal conditions; before you physically hit the brakes, in response to a hazard seen ahead. The average driver has a reaction time of ¾ second to one (1) second. At 55 mph this accounts for 61 feet traveled.

Braking Distance. The distance your vehicle will travel, in ideal conditions; while you are braking. At 55 mph on dry pavement with good brakes, it can take about 216 feet.

Total Stopping Distance. The total minimum distance your vehicle has traveled, in ideal conditions; with everything considered, including perception distance, reaction distance and braking distance, until you can bring your vehicle to a complete stop. At 55 mph, your vehicle will travel a minimum of 419 feet. See Figure 2.11.

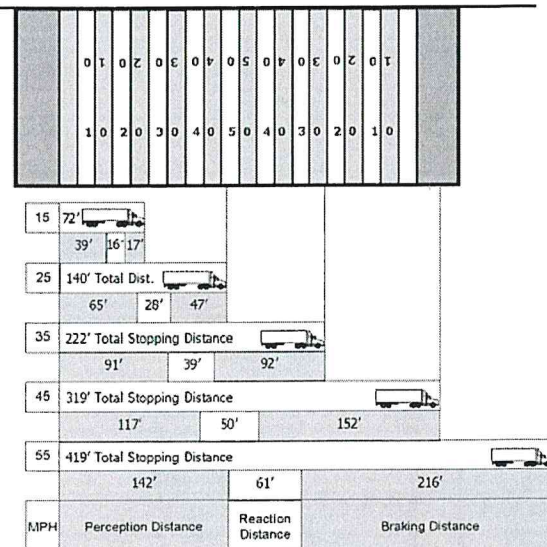


Figure 2.11

The Effect of Speed on Stopping Distance.

The faster you drive, the greater the impact or striking power of your vehicle. When you double your speed from 20 to 40 mph the impact is four (4) times greater. The braking distance is also four (4) times longer. Triple the speed from 20 to 60 mph and the impact and braking distance is nine (9) times greater. At 60 mph, your stopping distance is greater than the length of a football field. Increase the speed to 80 mph and the impact and braking distance are 16 times greater than at 20 mph. High speeds greatly increase the severity of crashes and stopping distances. By slowing down, you can reduce braking distance.

The Effect of Vehicle Weight on Stopping Distance.

The heavier the vehicle, the more work the brakes must do to stop it, and the more heat they absorb. But the brakes, tires, springs and shock absorbers on heavy vehicles are designed to work best when the vehicle is fully loaded. Empty trucks require greater stopping distances because an empty vehicle has less traction.

2.6.2 – Matching Speed to the Road Surface

You can't steer or brake a vehicle unless you have traction. Traction is friction between the tires and the road. There are some road conditions that reduce traction and call for lower speeds.

Slippery Surfaces. It will take longer to stop, and it will be harder to turn without skidding, when the road is slippery. Wet roads can double stopping distance. You must drive slower to be able to stop in the same distance as on a dry road.

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Reduce speed by about one-third (e.g., slow from 55 to about 35 mph) on a wet road. On packed snow, reduce speed by a half, or more. If the surface is icy, reduce speed to a crawl and stop driving as soon as you can safely do so.

Identifying Slippery Surfaces. Sometimes it's hard to know if the road is slippery. Here are some signs of slippery roads:

- ☐ **Shaded Areas.** Shady parts of the road will remain icy and slippery long after open areas have melted.
- ☐ **Bridges.** When the temperature drops, bridges will freeze before the road will. Be especially careful when the temperature is close to 32 degrees Fahrenheit.
- ☐ **Melting Ice.** Slight melting will make ice wet. Wet ice is much more slippery than ice that is not wet.
- ☐ **Black Ice.** Black ice is a thin layer that is clear enough that you can see the road underneath it. It makes the road look wet. Any time the temperature is below freezing and the road looks wet, watch out for black ice.
- ☐ **Vehicle Icing.** An easy way to check for ice is to open the window and feel the front of the mirror, mirror support, or antenna. If there's ice on these, the road surface is probably starting to ice up.
- ☐ **Just After Rain Begins.** Right after it starts to rain, the water mixes with oil left on the road by vehicles. This makes the road very slippery. If the rain continues, it will wash the oil away.
- ☐ **Hydroplaning.** In some weather, water or slush collects on the road. When this happens, your vehicle can hydroplane. It's like water skiing--the tires lose their contact with the road and have little or no traction. You may not be able to steer or brake. You can regain control by releasing the accelerator and pushing in the clutch. This will slow your vehicle and let the wheels turn freely. If the vehicle is hydroplaning, do not use the brakes to slow down. If the drive wheels start to skid, push in the clutch to let them turn freely.

It does not take a lot of water to cause hydroplaning. Hydroplaning can occur at speeds as low as 30 mph if there is a lot of water. Hydroplaning is more likely if tire pressure is low, or the tread is worn. (The grooves in a tire carry away the water; if they aren't deep, they don't work well.)

Road surfaces where water can collect can create conditions that cause a vehicle to hydroplane. Watch for clear reflections, tire splashes and raindrops on the road. These are indications of standing water.

2.6.3 – Speed and Curves

Drivers must adjust their speed for curves in the road. If you take a curve too fast, two things can happen. The tires can lose their traction and continue straight ahead, so you skid off the road. Or, the tires may keep their traction and the vehicle rolls over. Tests have shown that trucks with a high center of gravity can roll over at the posted speed limit for a curve.

Slow to a safe speed before you enter a curve. Braking in a curve is dangerous because it is easier to lock the wheels and cause a skid. Slow down as needed. Don't ever exceed the posted speed limit for the curve. Be in a gear that will let you accelerate slightly in the curve. This will help you keep control.

2.6.4 – Speed and Distance Ahead

You should always be able to stop within the distance you can see ahead. Fog, rain, or other conditions may require that you slow down to be able to stop in the distance you can see. At night, you can't see as far with low beams as you can with high beams. When you must use low beams, slow down.

2.6.5 – Speed and Traffic Flow

When you're driving in heavy traffic, the safest speed is the speed of other vehicles. Vehicles going the same direction at the same speed are not likely to run into one another. In many states, speed limits are lower for trucks and buses than for cars. It can vary as much as 15 mph. Use extra caution when you change lanes or pass on these roadways. Drive at the speed of the traffic, if you can without going at an illegal or unsafe speed. Keep a safe following distance.

The main reason drivers exceed speed limits is to save time. But, anyone trying to drive faster than the speed of traffic will not be able to save much time. The risks involved are not worth it. If you go faster than the speed of other traffic, you'll have to keep passing other vehicles. This increases the chance of a crash, and it is more tiring. Fatigue increases the chance of a crash. Going with the flow of traffic is safer and easier.

2005 Model Commercial Driver's License Manual**2.6.6 – Speed on Downgrades**

Your vehicle's speed will increase on downgrades because of gravity. Your most important objective is to select and maintain a speed that is not too fast for the:

- ☐ Total weight of the vehicle and cargo.
- ☐ Length of the grade.
- ☐ Steepness of the grade.
- ☐ Road conditions.
- ☐ Weather.

If a speed limit is posted, or there is a sign indicating "Maximum Safe Speed," never exceed the speed shown.

Also, look for and heed warning signs indicating the length and steepness of the grade. You must use the braking effect of the engine as the principal way of controlling your speed on downgrades. The braking effect of the engine is greatest when it is near the governed rpms and the transmission is in the lower gears. Save your brakes so you will be able to slow or stop as required by road and traffic conditions. Shift your transmission to a low gear before starting down the grade and use the proper braking techniques. Please read carefully the section on going down long, steep downgrades safely in "Mountain Driving."

2.6.7 – Roadway Work Zones

Speeding traffic is the number one cause of injury and death in roadway work zones. Observe the posted speed limits at all times when approaching and driving through a work zone. Watch your speedometer, and don't allow your speed to creep up as you drive through long sections of road construction. Decrease your speed for adverse weather or road conditions. Decrease your speed even further when a worker is close to the roadway.

Subsections 2.4, 2.5 and 2.6**Test Your Knowledge**

1. How far ahead does the manual say you should look?
2. What are two main things to look for ahead?
3. What's your most important way to see the sides and rear of your vehicle?
4. What does "communicating" mean in safe driving?

5. Where should your reflectors be placed when stopped on a divided highway?
6. What three things add up to total stopping distance?
7. If you go twice as fast, will your stopping distance increase by two or four times?
8. Empty trucks have the best braking. True or False?
9. What is hydroplaning?
10. What is "black ice"?

These questions may be on the test. If you can't answer them all, re-read subsections 2.4, 2.5 and 2.6.

2.7 – Managing Space

To be a safe driver, you need space all around your vehicle. When things go wrong, space gives you time to think and to take action.

To have space available when something goes wrong, you need to manage space. While this is true for all drivers, it is very important for large vehicles. They take up more space and they require more space for stopping and turning.

2.7.1 – Space Ahead

Of all the space around your vehicle, it is the area ahead of the vehicle--the space you're driving into--that is most important.

The Need for Space Ahead. You need space ahead in case you must suddenly stop. According to accident reports, the vehicle that trucks and buses most often run into is the one in front of them. The most frequent cause is following too closely. Remember, if the vehicle ahead of you is smaller than yours, it can probably stop faster than you can. You may crash if you are following too closely.

How Much Space? How much space should you keep in front of you? One good rule says you need at least one second for each 10 feet of vehicle length at speeds below 40 mph. At greater speeds, you must add 1 second for safety.

For example, if you are driving a 40-foot vehicle, you should leave four (4) seconds between you and the vehicle ahead. In a 60-foot rig, you'll need six (6) seconds. Over 40 mph, you'd need five (5) seconds for a 40-foot vehicle and seven (7) seconds for a 60-foot vehicle. See Figure 2.12.

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To know how much space you have, wait until the vehicle ahead passes a shadow on the road, a pavement marking, or some other clear landmark. Then count off the seconds like this: "one thousand- and-one, one thousand-and-two" and so on, until you reach the same spot. Compare your count with the rule of one second for every ten feet of length.

If you are driving a 40-foot truck and only counted up to 2 seconds, you're too close. Drop back a little and count again until you have four (4) seconds of following distance (or five [5] seconds, if you're going over 40 mph). After a little practice, you will know how far back you should be.

Remember to add one (1) second for speeds above 40 mph. And that when the road is slippery, you need much more space to stop.

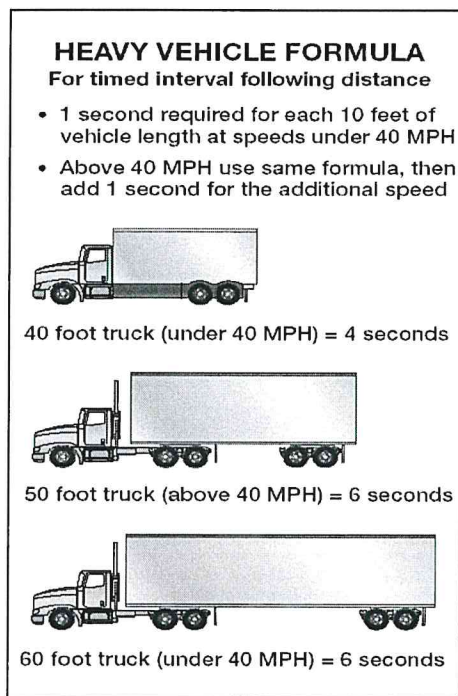


Figure 2.12

2.7.2 – Space Behind

You can't stop others from following you too closely. But there are things you can do to make it safer.

Stay to the Right. Heavy vehicles are often tailgated when they can't keep up with the speed of traffic. This often happens when you're going uphill. If a heavy load is slowing you down, stay in the right lane if you can. Going uphill, you should

not pass another slow vehicle unless you can get around quickly and safely.

Dealing with Tailgaters Safely. In a large vehicle, it's often hard to see whether a vehicle is close behind you. You may be tailgated:

- ☐ When you are traveling slowly. Drivers trapped behind slow vehicles often follow closely.
- ☐ In bad weather. Many car drivers follow large vehicles closely during bad weather, especially when it is hard to see the road ahead.

If you find yourself being tailgated, here are some things you can do to reduce the chances of a crash:

- ☐ Avoid quick changes. If you have to slow down or turn, signal early, and reduce speed very gradually.
- ☐ Increase your following distance. Opening up room in front of you will help you to avoid having to make sudden speed or direction changes. It also makes it easier for the tailgater to get around you.
- ☐ Don't speed up. It's safer to be tailgated at a low speed than a high speed.
- ☐ Avoid tricks. Don't turn on your taillights or flash your brake lights. Follow the suggestions above.

2.7.3 – Space to the Sides

Commercial vehicles are often wide and take up most of a lane. Safe drivers will manage what little space they have. You can do this by keeping your vehicle centered in your lane, and avoid driving alongside others.

Staying Centered in a Lane. You need to keep your vehicle centered in the lane to keep safe clearance on either side. If your vehicle is wide, you have little room to spare.

Traveling Next to Others. There are two dangers in traveling alongside other vehicles:

- ☐ Another driver may change lanes suddenly and turn into you.
- ☐ You may be trapped when you need to change lanes.

Section 6

COMBINATION VEHICLES

This Section Covers

- **Driving Combinations**
- **Combination Vehicle Air Brakes**
- **Antilock Brake Systems**
- **Coupling and Uncoupling**
- **Inspecting Combinations**

This section provides information needed to pass the tests for combination vehicles (tractor-trailer, doubles, triples, straight truck with trailer). The information is only to give you the minimum knowledge needed for driving common combination vehicles. You should also study Section 7 if you need to pass the test for doubles and triples.

6.1 – Driving Combination Vehicles

Safely

Combination vehicles are usually heavier, longer, and require more driving skill than single commercial vehicles. This means that drivers of combination vehicles need more knowledge and skill than drivers of single vehicles. In this section, we talk about some important safety factors that apply specifically to combination vehicles.

6.1.1 – Rollover Risks

More than half of truck driver deaths in crashes are the result of truck rollovers. When more cargo is piled up in a truck, the "center of gravity" moves higher up from the road. The truck becomes easier to turn over. Fully loaded rigs are ten times more likely to roll over in a crash than empty rigs.

The following two things will help you prevent rollover--keep the cargo as close to the ground as possible, and drive slowly around turns. Keeping cargo low is even more important in combination vehicles than in straight trucks. Also, keep the load centered on your rig. If the load is to one side so it makes a trailer lean, a rollover is more likely. Make sure your cargo is centered and spread out as much as possible. (Cargo distribution is covered in Section 3 of this manual.)

Rollovers happen when you turn too fast. Drive slowly around corners, on ramps, and off ramps. Avoid quick lane changes, especially when fully loaded.

6.1.2 – Steer Gently

Trucks with trailers have a dangerous "crack-the-whip" effect. When you make a quick lane change, the crack-the-whip effect can turn the trailer over. There are many crashes where only the trailer has overturned.

"Rearward amplification" causes the crack-the-whip effect. Figure 6.1 shows eight types of combination vehicles and the rearward amplification each has in a quick lane change. Rigs with the least crack-the-whip effect are shown at the top and those with the most, at the bottom. Rearward amplification of 2.0 in the chart means that the rear trailer is twice as likely to turn over as the tractor. You can see that triples have a rearward amplification of 3.5. This means you can roll the last trailer of triples 3.5 times as easily as a five-axle tractor.

Steer gently and smoothly when you are pulling trailers. If you make a sudden movement with your steering wheel, your trailer could tip over. Follow far enough behind other vehicles (at least 1 second for each 10 feet of your vehicle length, plus another second if going over 40 mph). Look far enough down the road to avoid being surprised and having to make a sudden lane change. At night, drive slowly enough to see obstacles with your headlights before it is too late to change lanes or stop gently. Slow down to a safe speed before going into a turn.

6.1.3 – Brake Early

Control your speed whether fully loaded or empty. Large combination vehicles take longer to stop when they are empty than when they are fully loaded. When lightly loaded, the very stiff suspension springs and strong brakes give poor traction and make it very easy to lock up the wheels. Your trailer can swing out and strike other vehicles. Your tractor can jackknife very quickly. You also must be very careful about driving "bobtail" tractors (tractors without semitrailers). Tests have shown that bobtails can be very hard to stop smoothly. It takes them longer to stop than a tractor-semitrailer loaded to maximum gross weight.

In any combination rig, allow lots of following distance and look far ahead, so you can brake early. Don't be caught by surprise and have to make a "panic" stop.